

Quality and productivity through paper machine rebuild

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It is certainly beyond the limits of this paper to discuss all the possibilities in detail

We all are papermakers knowing our machines and production lines.

Therefore, I should like to mention the most important items only.

The reason for investment is PROFIT.

The targets of a rebuild are :

- alteration of the production programme
- improvement of quality
- improvement of runability
- increasing of production
- reduction of specific energy consumption
- reduction of specific man power.

Does it pay to rebuild a production line? Generally the answer is YES. Modern paper machines for newsprint or folding box board achieve a specific production of 70-80 tpd per meter of width.

A modern newsprint machine achieved 1453m/min in October 1990, producing 94 tpd/m. The fastest tissue machine arrived at 2050 m/min in U.S.A.

There are many paper machines in operation far below these figures.

The decision for a rebuild always needs an individual bottle neck study and a feasibility study.

I should like to omit details of the stock preparation.

The various machines have to be checked, probably replaced by bigger units or to be completed by additional units.

In the western hemisphere many paper machines are one-purpose machines providing for the best results.

The requirements of other market areas might gear the paper mill to produce a wide range of products on one paper machine. This leads to some compromise in the layout.

We suggest to reduce the range of qualities as far as possible.

The approach flow system and the wet end have to be considered as one integrated part.

When rebuilding the wet end of a small PM in China, we achieved 19% more production with a modern approach flow system and our standard air cushion headbox with rectifier roll.

The target had been the significant reduction of basis weight variation on coating base paper.

This improvement reduced the downtime because of paper breaks and allowed for a better control of the drying process.

A constant consistency and a constant flow rate coming from the machine chest is only one item.

The white water has to flow horizontally from the white water tray into the white water tower, avoiding cascades and foam. The wide overflow edge keeps the level in the white water tower constant and both, cleaner pump and headbox pump have a constant pressure on suction side.

If there is a turbulence on suction side, even the best pump might introduce pulsation.

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Preferable the accepted cleaner stock and the various by pass quantities get injected into the headbox pump in axial direction.

The pumps must have stable characteristics. Otherwise pulsation will occur.

The arrangement of the pipes between pressure screen and headbox is as important.

The most advantageous arrangement is if the pipe comes from the pressure screen on ground floor in one-x-y, plane to the headbox. A pipe arrangement like in x-y-z diagram would introduce turbulence and pulsation.

The installation of foil boxes instead of table rolls is state of art and well known.

An automatic wire stretcher combined with a separate tension measuring unit near the wire drive roll helps for a longer life time, reducing downtime.

Instead of extending the fourdrinier a top dewatering unit like the DANDY FORMER might help for 3 reasons :

- It acts like a dandy roll, improving the formation.
- It provides for additional drainage capacity.
- It provides for symmetric drainage and distribution of filler and fines, reducing doublesidedness.

Reducing downtime is a challenging task for the mill staff. If you want to avoid breaks, you will need a compact press configuration which avoids open paper draw to a certain extent.

Felt conditioning is another essential item.

If it is not done properly, you will get stripes in the felts as well as in the paper.

We have to provide for low pressure curtain showers, high pressure oscillating showers combined with suction tubes (Uhle boxes) and suitable felts as well.

When studying bottlenecks the capacity of the dryer section is of essential significance.

One percent dry content more or less after the press section counts for plus or minus 5% of drying capacity, 5% more production or steam saving.

Very often the dry content was told us to be 42 or 43%.

This cannot correspond with reality, if the presses allow for a nip pressure of 30–50 kN/m only. A precise evaluation has to be done in this respect.

A properly designed compact press section needs little space only. The remaining gap is available for 2–4 additional dryer cylinders.

Further rebuilding components are :

- Dryer fabrics instead of felts
- Pocket ventilation
- Blower rolls such as Middleline rolls
- Closed hoods with or without heat recovery
- Inclined size presses or breaker stacks,
- In order to streamline the paper run, avoiding breaks
- Steam and condensate systems of cascade type utilizing the temperature and steam pressure difference only or applying the compressor system which is more flexible if the production programme of the paper machine is very wide.

At the dry end of the paper machine there is the possibility to install a hard nip calender stack with temperature controlled Flexitherm rolls and swimming rolls or Hydrein rolls.

Crown controlling provides for the possibility to vary the nip pressure. Flexitherm rolls with heating and cooling system allow for calendering with lower nip pressure and suitable temperature.

Depending on the required bulk and smoothness, a Soft Compact Calender could be installed in-line instead of the hard nip calender stack.

The SCC cannot replace a Supercalender in any case.

But may applications allow for SSC in-line calendering in order to avoid off-line supercalendering.

The SSC consists of a combination of Flexitherm rolls with PU-lined swimming rolls or sectionally controlled Hydrein rolls. The Flexitherm rolls are heated internally with hot water or in the upper range with thermo-oil.

The application of a SCC requires an even profile in basis weight and moisture as well as attention from the operators. The temperature of the Flexitherm rolls is controlled automatically. For the supervision of the temperature of plastic-lined rolls pivotable cameras are monitoring the temperature of the rolls surface and adjustable blower nozzles provide for cooling air where it is needed.

When calendering of coated paper has to be done a camera supervises the roll surface and indicates when coating particles are picked up by the roll.

A cleaning unit is available to keep the elastic roll in proper condition.

Spreader rolls and photocells protect the rolls against accidents during operation.

The SCC can process a wide variety of paper qualities such as newsprint, coated or uncoated printing paper, LWC, folding box board, decorative paper or liquid packaging base paper.

We know that in India smoothness as well as gloss are required on maplitho and poster paper. But the worldwide trend goes to smooth and mat, not glossy.

As my company, NEUE BRUDERHAUS is specialized in fine paper machines, I did not refer to other paper grades like fluting and liner or multiply board.

When aiming at higher speed you have to replace cylinder vat formers by suction former or even by multi-fourdrinier.

One fluting machine under construction in Germany has a layout for 115 tpd/m.

Obviously such a machine has a lot of sophisticated equipment, for instance

crown adjustable roll in the press section,
a double-felted press with long nip for 300 kN/m,
moisture control after the presses and before the size press as well as a B + M unit before the reeler.

I would like to mention just one installation for 420 tpd which has in the on-line control system

78 control loops
356 measured parameters
373 controlled valves and motors
as well as various monitors and printers covering the entire production line from the pulper up to the pope reeler.

When rebuilding a production line in order to get more production, we must not forget to consider the surrounding units such as :

- energy supply
- steam generation
- fresh water and effluent treatment
- handling of furnish and products
- slitter winder
- supercalender and
- reel handling systems

When investigating a rebuilding project, we generally suggest to do a big step forward.

If you have to do it step by step for certain reasons, you should have an overall concept as a guide line.

The first step should not prevent the second one.

A reliable engineering based on experience is needed on both ends, from the supplier's side as well as in the paper mill.